

CHINESE MED J-PEKING | 中国八城市孕妇营养素摄入量及其相关因素：一项横断面研究

本文关键字：膳食评估、脂肪、营养素摄入、生理状态、孕妇

影响因子：1.596

建议阅读时间：2 分钟

背景

在过去 30 年里，中国人的膳食模式发生了巨大变化，尤其是城市居民。本次研究旨在确定中国城市孕妇每日营养素摄入量的状况和相关因素。

方法

研究采用多阶段分层随机抽样方法进行横断面研究，共纳入了中国 8 个城市的 479 名处于怀孕三个孕期的女性。采用 24 小时膳食回顾法评估了营养素摄入情况，并与 2013 年中国膳食参考摄入量 (DRIs) 进行了对比。

结果

大多数孕妇的宏量营养素分布不均衡，摄入了过多来源于脂肪的能量。维生素 A、维生素 B6、钙、锰和硒的摄入量低于中国推荐营养素摄入量 (RNI) 以及各个孕期的平均需要量 (EARs)。大多数孕妇在孕早期摄入较多叶酸，在孕中期和孕晚期的摄入量显著减少 ($P < 0.05$)。同时我们发现大多数孕妇在孕晚期铁摄入不足，同时也有部分孕妇可能存在铁摄入过量的风险。维生素 B1 摄入量在孕早期符合 RNI，但在整个孕期低于 EAR。孕期分期与大部分营养素呈正相关 ($P < 0.05$)。而孕期体质指数与能量、脂肪、维生素 C 以

及钙的摄入量呈负相关 ($P < 0.05$)。教育水平及家族收入与叶酸摄入量呈正相关 ($P < 0.05$)。

结论

与我国 2013 年的 DRIs 相比，目前中国城市地区孕妇产前饮食选择与营养素摄入不均衡，特别是从脂肪和微量营养素中摄取的能量。应给孕妇提供适当的饮食建议，提倡均衡饮食，避免高脂肪含量的食物，并纳入在常规孕期饮食中普遍缺乏的是重要微量营养素良好来源的食物。同时需要进行进一步的研究，以了解造成这一饮食不均衡的饮食习惯和食物模式，从而能够有效改善产前女性的营养素摄入状况。

参考文献：

Liu FL, et al. Chin Med J (Engl). 2015 Jul 5;128(13):1778-86.

文献链接：<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4733713/>

Table 1: Demographic characteristics of Chinese pregnant women in eight cities (*n* = 479)

Characteristics	Results (<i>n</i>)	Percentage (%)
Age at interview (years)		
<25	122	25.5
25–29	242	50.5
≥30	112	23.4
Trimester		
First	158	33.0
Second	160	33.4
Third	161	33.6
Education		
Junior high school or lower	60	12.5
Senior high school and college	378	78.9
Graduate or higher	34	7.1
Household income per capita per month (RMB, Yuan)		
≤1500	55	11.5
1501–3999	245	51.2
≥4000	175	36.5
Prepregnancy BMI (kg/m ²)		
<18.5	105	21.9
18.5–23.9	314	65.6
≥24.0	60	12.5

BMI: Body mass index.

Table 2: Energy and nutrient intakes (mean \pm SD) of women during pregnancy from 24 h recall

Energy and nutrients	All subjects (n = 479)	First trimester (n = 158)	Second trimester (n = 160)	Third trimester (n = 161)	P*
Energy (kcal)	2098 \pm 915	2001 \pm 990	2060 \pm 773	2219 \pm 960 ^g	0.034
Percentage of energy from fat (%)	36.4 \pm 11.5	37.0 \pm 12.1	36.8 \pm 11.6	35.5 \pm 10.6	0.242
Percentage of energy from carbohydrates (%)	51.5 \pm 12.6	51.21 \pm 13.0	50.77 \pm 13.1	52.57 \pm 11.5	0.333
Percentage of energy from protein (%)	15.0 \pm 5.0	14.7 \pm 4.9	15.6 \pm 4.9	14.7 \pm 4.2	0.963
Carbohydrate (g)	268.9 \pm 137.1	257.2 \pm 155.6	258.6 \pm 111.6	290.7 \pm 139.0 ^h	0.029
Fat (g)	84.5 \pm 46.5	81.5 \pm 48.7	85.0 \pm 45.7	86.9 \pm 45.1	0.577
Protein (g)	79.3 \pm 44.4	73.5 \pm 42.3	80.8 \pm 41.3	83.6 \pm 48.8 ^h	0.042
Cholesterol (mg)	514.5 \pm 490.9	483.3 \pm 343.6	557.9 \pm 645.0	501.9 \pm 433.4	0.735
Dietary fiber (g)	14.9 \pm 10.6	13.6 \pm 10.4	15.3 \pm 9.4	15.8 \pm 11.7	0.063
Vitamin A (μ g, RAE) [†]	591.5 \pm 878.4	437.5 \pm 374.3	662.6 \pm 988.9 ^g	671.9 \pm 1077.4 ^g	0.017
Retinal (μ g)	378.9 \pm 824.5	260.8 \pm 285.7	447.8 \pm 948.3	426.4 \pm 1018.1	0.088
Thiamin (mg)	1.2 \pm 0.9	1.2 \pm 1.0	1.2 \pm 0.9	1.2 \pm 0.7	0.778
Riboflavin (mg)	1.3 \pm 0.9	1.2 \pm 0.9	1.4 \pm 1.1	1.4 \pm 0.9	0.323
Niacin (mg)	17.2 \pm 10.6	15.4 \pm 9.5	17.7 \pm 9.9	18.4 \pm 12.1 ^h	0.001
Vitamin B6 (mg)	1.1 \pm 0.7	1.1 \pm 0.6	1.1 \pm 0.6	1.2 \pm 0.7	0.162
Biotin (μ g)	51.8 \pm 52.0	47.9 \pm 52.5	51.0 \pm 37.1	56.4 \pm 63.1	0.394
Folic acid (μ g DFE)	425.9 \pm 317.7	583.4 \pm 301.7	346.9 \pm 245.9 ^h	347.2 \pm 339.3 ^h	0.000
Vitamin C (mg)	133.0 \pm 129.2	113.9 \pm 93.5	140.2 \pm 131.7	144.4 \pm 153.2 ^h	0.035
Vitamin E (mg α -TE)	14.5 \pm 14.0	14.0 \pm 15.1	15.6 \pm 16.1	14.1 \pm 12.1	0.914
Ca (mg)	734.1 \pm 562.9	633.2 \pm 492.4	746.6 \pm 460.0	820.6 \pm 693.4 ^h	0.003
P (mg)	1182.7 \pm 603.9	1089.5 \pm 609.8	1189.9 \pm 510.2	1272.3 \pm 669.9 ^h	0.006
K (mg)	2353.3 \pm 1263.3	2102.1 \pm 1153.6	2415.2 \pm 1108.9	2535.4 \pm 1460.1 ^h	0.002
Na (mg)	4496.4 \pm 6210.1	4334.9 \pm 2518.1	5147.3 \pm 9739.3	4008.1 \pm 3747.3	0.638
Mg (mg)	336.3 \pm 193.2	309.3 \pm 199.1	335.8 \pm 171.0	363.5 \pm 205.3 ^h	0.040
Fe (mg)	27.3 \pm 20.1	26.2 \pm 20.8	26.8 \pm 16.7	28.9 \pm 22.4	0.234
Zn (mg)	12.6 \pm 6.9	11.7 \pm 7.1	12.7 \pm 5.8	13.3 \pm 7.6 ^h	0.003
Se (μ g)	54.4 \pm 35.0	50.2 \pm 31.7	57.6 \pm 36.1	55.5 \pm 36.8	0.179
Cu (mg)	2.5 \pm 2.1	2.4 \pm 2.0	2.5 \pm 1.5	2.6 \pm 2.6	0.478
Mn (mg)	6.0 \pm 5.9	5.7 \pm 3.4	6.1 \pm 7.6	6.8 \pm 10.8	0.070

*P for one-way ANOVA; [†]RAE: Retinol activity equivalents; [‡]The formula of Vitamin A defined in Chinese DRIs 2013; RAE: Retinol + 1/12 total carotene; [§]P<0.05 compared with the first trimesters; ^{||}P<0.01 compared with the first trimesters. SD: Standard deviation; α -TE: Alpha-tocopherol equivalents.

Table 3: Energy and nutrient intakes distribution of Chinese pregnant women in the first trimester (*n* = 158)

Energy and nutrients	DRIs			Intake percentiles				
	EAR*	RNI [†] /AI [‡]	UL [§]	10 th	25 th	Median	75 th	90 th
Energy (kcal)	–	–	–	1075.6	1345.9	1794.9	2343.0	3138.0
Fat (g)	–	–	–	34.5	52.7	70.1	100.4	141.0
Protein (g)	50	–	–	35.4	43.9	62.4	91.7	144.5
Carbohydrate (g)	130	–	–	110.4	153.8	239.4	308.7	410.6
Fat (%TE)**	–	–	–	22.0	29.0	37.7	44.5	52.4
Protein (%TE)**	–	–	–	9.2	11.7	13.9	16.8	21.6
Carbohydrate (%TE)**	–	–	–	35.9	42.2	50.1	60.2	67.7
Dietary fiber (g)	–	25	–	4.5	7.3	10.8	15.9	25.1
Cholesterol (mg)	–	–	–	37.5	197.2	465.3	715.4	938.4
Vitamin A (µg, RAE) [†]	480	700	3000	80.6	174.2	328.0	498.2	666.0
Retinal (µg) [†]	–	–	3000	16.7	72.5	193.3	326.3	496.7
Thiamin (mg)	1.0	1.2	–	0.4	0.6	0.9	1.3	2.3
Riboflavin (mg)	1.0	1.2	–	0.4	0.7	1.0	1.4	2.5
Niacin (mg Ne)	10	12	35	6.2	9.1	12.6	20.3	28.4
Vitamin B6 (mg)	1.9	2.2	60	0.4	0.6	1.0	1.4	2.0
Biotin (µg)	–	40	–	16.9	25.3	34.6	50.0	78.7
Folic acid (µg DFE)	520	600	1000	187.0	459.4	569.4	697.0	951.3
Vitamin C (mg)	85	100	2000	19.9	45.5	83.8	167.6	253.0
Vitamin E (mg α-TE)	–	14	700	5.3	7.6	10.6	14.1	20.0
Ca (mg)	650	800	2000	188.2	291.0	498.5	814.8	1311.2
P (mg)	600	720	3500	525.1	682.6	969.1	1331.1	1822.2
K (mg)	–	2000	–	873.2	1262.3	1934.4	2637.4	3609.1
Na (mg)	–	1500	–	2333.0	2968.7	3939.7	5032.7	6471.7
Mg (mg)	310	370	–	138.6	179.1	272.6	370.7	528.5
Fe (mg)	15	20	40	10.5	14.5	20.0	28.2	52.2
Zn (mg)	7.7	9.5	40	5.2	6.9	10.1	14.4	19.7
Se (µg)	54	65	400	17.0	29.9	44.0	59.7	90.1
Cu (mg)	0.7	0.9	8	0.9	1.2	1.8	3.0	4.9
Mn (mg)	–	4.9	11	2.1	3.0	4.1	6.2	9.9

*EAR: Estimated average requirement; [†]RNI: Recommended nutrient intake; [‡]AI: Adequate intake; [§]UL: Upper intake level; [†]RAE: Retinol activity equivalents. [†]The UL for Vitamin A is based on preformed Vitamin A (retinol). Assessment of the proportion of the population with intakes above the UL is based on intakes of preformed Vitamin A rather than total RAEs. **%TE: Percentage of total energy. α-TE: Alpha-tocopherol equivalents; DRIs: Dietary reference intakes.

Table 4: Energy and nutrient intakes distribution of Chinese pregnant women in the second trimester (n = 160)

Energy and nutrients	DRIs			Intake percentiles				
	EAR*	RNI ¹ /AI ²	UL ³	10 th	25 th	Median	75 th	90 th
Energy (kcal)	–	–	–	1213.1	1505.1	1946	2418.7	3137.6
Fat (g)	–	–	–	39.6	52.2	76.3	109.0	137.3
Protein (g)	60	–	–	39.3	50.2	69.8	99.4	141.3
Carbohydrate (g)	130	–	–	133.1	183.1	241.8	312.5	416.3
Fat (%TE)**	–	–	–	20.9	28.6	36.4	44.8	53.6
Protein (%TE)**	–	–	–	10.7	12.4	14.2	17.9	22.2
Carbohydrate (%TE)**	–	–	–	33.2	41.5	50.9	59.6	69.3
Dietary fiber (g)	–	25	–	6.6	8.2	13.2	19.7	27.3
Cholesterol (mg)	–	–	–	82.2	192.6	438.9	709.5	1201.7
Vitamin A (μg, RAE) ⁴	530	770	3000	127.5	197.1	343.3	589.9	1024.7
Retinal (μg) ⁵	–	–	3000	26.5	87.5	199.5	363.0	745.0
Thiamin (mg)	1.1	1.4	–	0.5	0.7	1.0	1.5	2.2
Riboflavin (mg)	1.1	1.4	–	0.5	0.8	1.2	1.7	2.8
Niacin (mg NE)	10.0	12.0	35	7.3	10.7	15.5	22.0	32.8
Vitamin B ₆ (mg)	1.9	2.2	60	0.5	0.7	1.1	1.5	1.9
Biotin (μg)	–	40	–	22.0	28.0	40.2	58.8	92.2
Folic acid (μg DFE)	520	600	1000	94.3	147.5	264.1	490.1	713.1
Vitamin C (mg)	95	115	2000	23.8	64.9	111.7	187.7	262.3
Vitamin E (mg α-TE)	–	14	700	4.9	7.9	11.9	19.6	27.3
Ca (mg)	810	1000	2000	236.9	392.4	659.3	1007.3	1314.2
P (mg)	600	720	3500	578.2	809.3	1086.2	1447.2	2027.0
K (mg)	–	2000	–	1110.1	1567.6	2263.3	3209.6	3774.2
Na (mg)	–	1500	–	984.1	2729.3	3888.1	5005.4	7056.6
Mg (mg)	310	370	–	141.8	209.5	305.5	399.2	602.2
Fe (mg)	19.0	24.0	40	11.9	15.7	21.7	32.2	50.0
Zn (mg)	7.7	9.5	40	5.8	8.2	11.6	15.9	21.3
Se (μg)	54	65	400	24.6	32.7	48.1	70.9	102.0
Cu (mg)	0.7	0.9	8	1.0	1.4	2.0	3.4	4.7
Mn (mg)	–	4.9	11	2.2	3.2	5.0	7.0	8.5

*EAR: Estimated average requirement; ¹RNI: Recommended nutrient intake; ²AI: Adequate intake; ³UL: Upper intake level. ⁴RAE: Retinol activity equivalents. ⁵The UL for Vitamin A is based on preformed Vitamin A (retinol). Assessment of the proportion of the population with intakes above the UL is based on intakes of preformed Vitamin A rather than total RAEs. **%TE: Percentage of total energy; DRIs: Dietary reference intakes; α-TE: Alpha-tocopherol equivalents.

Table 5: Energy and nutrient intakes distribution of Chinese pregnant women in the third trimester (n = 161)

Energy and nutrients	DRIs			Intake percentiles				
	EAR*	RNI [†] /AI [‡]	UL [§]	10 th	25 th	Median	75 th	90 th
Energy (kcal)	–	–	–	1306.0	1564.2	2043.8	2564.6	3520.6
Fat (g)	–	–	–	43.8	54.0	80.8	107.7	134.3
Protein (g)	75	–	–	37.5	49.5	72.7	105.2	142.6
Carbohydrate (g)	130	–	–	142.5	195.1	266.9	341.6	481.1
Fat (%TE)**	–	–	–	22.4	27.7	35.1	43.3	50.3
Protein (%TE)**	–	–	–	10.3	11.7	14.0	17.0	20.7
Carbohydrate (%TE)**	–	–	–	37.8	44.8	51.6	61.2	67.2
Dietary fiber (g)	–	25	–	5.2	8.2	13.6	19.8	27.6
Cholesterol (mg)	–	–	–	60.9	159.4	399.9	707.3	1028.2
Vitamin A (µg, RAE) [¶]	530	770	3000	90.2	203.7	353.6	625.6	973.5
Retinal (µg) [¶]	–	–	3000	26.3	79.0	201.9	362.4	577.8
Thiamin (mg)	1.2	1.5	–	0.5	0.7	1.0	1.4	2.1
Riboflavin (mg)	1.2	1.5	–	0.5	0.8	1.2	1.7	2.4
Niacin (mg NE)	10	12	35	7.8	10.8	14.8	21.6	33.8
Vitamin B ₆ (mg)	1.9	2.2	60	0.4	0.7	1.1	1.5	2.2
Biotin (µg)	–	40	–	18.2	28.2	39.5	60.8	104.6
Folic acid (µg DFE)	520	600	1000	91.9	143.2	269.3	431.5	670.1
Vitamin C (mg)	95	115	2000	30.7	64.3	111.6	178	256.9
Vitamin E (mg α-TE)	–	14	700	6.3	8.3	11.2	15.7	24.7
Ca (mg)	810	1000	2000	233.6	417.7	710.5	1008.8	1319.6
P (mg)	600	720	3500	582.2	858.0	1105.9	1572.1	2080.9
K (mg)	–	2000	–	1133.0	1506.0	2312.4	3268.1	4081
Na (mg)	–	1500	–	918.5	2544.8	3707.4	4748.9	6392.5
Mg (mg)	310	370	–	166.0	227.8	322.7	445.1	586.8
Fe (mg)	22	29	40	11.8	16.1	21.6	33.7	53.7
Zn (mg)	7.7	9.5	40	6.5	8.3	11.6	16	24.4
Se (µg)	54	65	400	20.0	30.5	51.0	66.3	97.5
Cu (mg)	0.7	0.9	8	0.9	1.4	2.1	2.9	4.4
Mn (mg)	–	4.9	11	2.5	3.6	5.3	6.9	10.9

*EAR: Estimated average requirement; †RNI: Recommended nutrient intake; ‡AI: Adequate intake; §UL: Upper intake level. ¶RAE: Retinol activity equivalents; †The UL for Vitamin A is based on preformed Vitamin A (retinol). Assessment of the proportion of the population with intakes above the UL is based on intakes of preformed Vitamin A rather than total RAEs. **%TE: Percentage of total energy; DRIs: Dietary reference intakes.

Table 6: Multiple linear regression between energy and nutrients and pregnant women's demographic characteristics

Energy and nutrients	Trimester		Prepregnancy BMI		Household income		Education	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Energy (kcal)	115.57	14.463, 216.678	–169.894	–312.396, –27.391				
Protein (g)	5.204	0.303, 10.106						
Fat (g)			–8.512	–15.752, –1.271				
Carbohydrate (g)	18.627	3.497, 33.757						
Vitamin A (µg, RAE)	118.942	20.489, 217.395						
Niacin (mg NE)	1.593	0.413, 2.774						
Folic acid (µg DFE)					57.147	11.414, 102.88	87.321	20.263, 154.379
Vitamin C (mg)	15.077	0.752, 29.402	–23.469	–44.14, –2.798				
Ca (mg)	94.846	32.904, 156.789	–101.168	–188.471, –13.865				
P (mg)	93.52	26.736, 160.304						
K (mg)	220.971	81.15, 360.793						
Mg (mg)	28.597	7.319, 49.876						
Zn (mg)	0.878	0.112, 1.644						

β: Regression coefficient; CI: Confidence interval; BMI: Body mass index; RAE: Retinol activity equivalents.